WHAT IS CLAIMED IS:

1. An installation for processing metal bars, particularly bars intended for concrete reinforcement, comprising:

means for transferring one or more bars (B) from at least a first station in said installation to at least a second station,

in which said means comprise at least a set of gripping pliers (i.e. at least one gripper) comprising:

jaw means movable between an open condition and a closed condition and

a movable structure for supporting the jaw means, which is movable in the installation in at least a direction transverse relative to a longitudinal direction of lay of the bars in the installation,

said installation being characterised in that:

- the aforesaid jaw means of the, or of each, set of pliers are mounted on said movable support structure in articulated fashion about a substantially horizontal axis of articulation, and

- means are provided for controlling the rotation of said jaw means about said axis of articulation and consequently for positioning said set of pliers in any angular position relative to said axis of articulation,

- so that the set of pliers is able to grip one or more bars in correspondence with said first station, keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars in said second station always keeping them substantially side by side with respect to each other in a plane having a second orientation which can be different from said first orientation.

2. An installation as claimed in claim 1, wherein the, or each, set of pliers is capable of loading one or more bars from a first station which receives bars destined to be subjected to a bending operation to a second station constituted by an area for receiving the bars to be bent over one or more bending units.

3. An installation as claimed in claim 2, in which the, or each, bending unit comprises a revolving disk for supporting the bars to be bent, with a central axial mandrel about which the bars are bent and an eccentric pivot pin for bending the bars about the mandrel, as well as an abutment element against which the bars bear laterally during the bending operation, said central mandrel and said abutment element defining between them said area for receiving the bars to be bent, in which the bars are arranged side by side to each other in a plane substantially perpendicular to the plane of the bending disc.

4. An installation as claimed in claim 2 or 3, wherein the, or each, set of pliers is also capable of drawing one or more bars form the aforesaid receiving area over each bending unit, after the bars are bent, and of depositing the bent bars in a third station of the installation.

5. An installation as claimed in claim 1, wherein the movable structure supporting the jaw means of the, or of each, set of pliers is movable both along a first direction which is horizontal and parallel to a longitudinal direction of lay of the bars in the installation, and along a second direction which is horizontal and perpendicular to the longitudinal direction of the bars.

6. An installation as claimed in claim 5, wherein said movable structure can also move in a third direction which is perpendicular to a plane of said second station.

7. An installation as claimed in claim 6, wherein the plane of said second station is horizontal, so that the aforesaid third direction of motion of the movable structure of the set of pliers is the vertical direction.

8. An installation as claimed in claim 6, wherein the plane of said second station is inclined relative to a horizontal plane, so that the aforesaid third direction of the motion of the movable structure of the pliers is in an inclined direction relative to the vertical direction.

9. An installation as claimed in claim 5, wherein the movable support structure is mounted along a slide or carriage which is movable along a raised cross member structure which in turn is movable in the manner of an overhead travelling crane relative to the fixed structure.

10. An installation as claimed in claim 6, wherein the movable support structure is mounted on a slide or carriage which is movable along a raised cross member structure which in turn is movable in the manner of an overhead travelling crane on raised horizontal beams of a fixed frame overlying the installation, said movable structure being mounted in sliding fashion on said slide or carriage along said third direction.

11. An installation as claimed in claim 9 or 10, wherein said frame overlies the installation for an extension sufficient to use the, or each, set of pliers in order to:

- draw one or more bars from a first station which receives bars destined to be subjected to a bending operation and transfer them and depositing them in a second station constituted by an area for receiving the bars to be bent over one or more bending unit, and also in order to

- draw one or more bars from the aforesaid reception area above every bending unit, after the bars have been bent, and transfer and deposit the bent bars in a third station of the installation.

12. An installation as claimed in claim 9 or 10, wherein comprises a plurality of sets of gripping pliers, each with jaw means borne by a respective movable support structure, the support structures of the various pliers being all movable on the aforesaid raised structure.

13. An installation as claimed in claim 9 or 10, wherein it comprises a plurality of sets of gripping pliers, each with jaw means borne by a respective movable support structure, the support structures of the various pliers being movable along respective raised cross member structures able to slide in the manner of overhead travelling cranes on the frame.

14. An installation as claimed in claim 1 or 2 or 3 or 4, wherein said plane of drawing of the bars having the said first orientation is substantially parallel to a plane of lay of the bars in said first station and said plane of unloading of the bars, having the

aforesaid second orientation, is a plane which can also be considerably inclined relative to the horizontal.

15. An installation as claimed in claim 14, wherein the drawing plane is substantially horizontal, that said second station defines a plane and that said plane of unloading of the bars, having the aforesaid second orientation, is substantially perpendicular to said plane of the second station.

16. An installation as claimed in claim 15, wherein said plane of the second station is substantially horizontal and said plane of unloading of the bars, having the aforesaid second orientation, is substantially vertical.

17. An installation as claimed in claim 15, wherein said plane of the second station is inclined relative to the horizontal and in that said unloading plane of the bars, having the aforesaid second orientation, is consequently inclined relative to the vertical.

18. **An installation** as claimed in any of the claims 1-3, wherein said first station is constituted by a drawing plane whereon the bars are supplied to be cut into segments of predetermined length, whilst said second station is a bending station comprising two mutually distanced bending units, positioned laterally relative to the drawing plane, whereon the cut bars are set down to be bent according to predetermined shapes.

19 Installation as claimed in claim 18, wherein the two bending units are movable with respect to one another in the longitudinal direction of the bars.

20. An installation as claimed in claim 18, wherein on said drawing plane are positioned means for referring longitudinally in position the bars to be cut, in such a way that the cut bars are already in the correct position, with reference to the longitudinal direction, relative to the bending units, said pliers transferring means thus transferring the bars from the cutting plane to the bending machines without changing their longitudinal position.

21. An installation as claimed in claim 1 or 2, wherein the drawing plane is defined by the upper branches of a plurality of closed loop chains arranged in vertical planes parallel to the transverse direction or by a plurality of mutually parallel screw conveyors.

22. An installation as claimed in claim 1, wherein it comprises a plurality of sets of gripping pliers, each with jaw means borne by a respective movable support structure, the support structures of the various pliers being all fastened to a raised cross member structure that is movable in the manner of an overhead travelling crane in the aforesaid transverse direction relative to the fixed structure.

23. An installation as claimed in claim 1, wherein it comprises a plurality of sets of gripping pliers, each with jaw means borne by a respective movable support structure, the support structures of the various jaws all being movable in the aforesaid transverse direction on respective raised cross member structures which are fixed and longitudinally distanced from each other.

24. An installation as claimed in claim 18, wherein it is provided with means for unloading the bars on a side of said drawing plane opposite the one oriented towards the bending units.

25. An installation as claimed in claim 24, wherein it comprises one or more roller tracks or one or more storage compartments to receive bars unloaded on said opposite side which are not destined to be subjected to a bending operation.

26. An installation as claimed in claim 6 or 10, wherein the jaw means of the pliers are swivelling relative to the support structure also about an axis that is parallel to said third direction.

27. An installation as claimed in any of the claims 8-10 and 12,13, wherein the movable support structure is mounted on a slide or carriage which is movable along a raised cross member structure which in turn is movable in the manner of overhead travelling crane on raised beams of a frame which overlies the installation, said raised beams extending parallel to the plane of said second station, defined by the plane of the bending disk of the, or of each, bending unit.

28. An installation as claimed in claim 1, wherein to said pliers gripping means are associated sensor means able to sense positions along the bars where the bars can be gripped.

29. A method for transferring a plurality of bars in an installation for processing metal bars, particular bars intended for concrete reinforcement, in which said installation comprises means for

transferring one or more bars from at least a first station in said installation to at least a second station, in which said means comprise at least a set of gripping pliers (i.e. at least one gripper) comprising:

jaw means movable between an open condition and a closed condition and

a movable structure for supporting the jaw means, which is movable in the installation in at least a direction transverse relative to a longitudinal direction of lay of the bars in the installation,

said installation being wherein:

- the aforesaid jaw means of the, or of each, set of pliers are mounted on said movable support structure in articulated fashion about a substantially horizontal axis of articulation,

- means are provided for controlling the rotation of said jaw means about said axis of articulation and consequently for positioning said set of pliers in any angular position relative to said axis of articulation,

- said pliers gripping means are commanded in such a way as to grip one or more bars in correspondence with said first station, keeping them substantially side by side with respect to each other in a plane having a first orientation, and to deposit said bars in said second station always keeping them substantially side by side with respect to each other in a plane having a second orientation different from said first orientation, after making, if necessary, said pliers means perform a rotation about said axis of articulation.

30. A method as claimed in claim 29, wherein said drawing plane of the bars, having the aforesaid first orientation, is substantially parallel to a plane of lay of the bars in said first station.

31. A method as claimed in claim 29 or 30, wherein said drawing plane of the bars, having the aforesaid first orientation, is substantially horizontal.

32. Method as claimed in any of the previous claims 29-31, wherein said plane for unloading the bars, having the aforesaid second orientation, is substantially vertical and perpendicular to a plane of said second station, which is horizontal.

33. A method as claimed in any of the claims 29-31, wherein said plane for unloading the bars, having the aforesaid second orientation, is inclined relative to the vertical and is perpendicular to a plane of said second station, which is correspondingly inclined relative to the horizontal.

34. A method as claimed in any of the claims 29-33, wherein the, or each, set of pliers loads one or more bars from a first station which receives bars destined to be subjected to a bending operation, and transfers the loaded bars to a second station constituted by an area for receiving the bars to be bent over one or more bending unit.

35. A method as claimed in any of the claims 32-34, in which the, or each, bending unit comprises a swivelling disk for supporting the bars to be bent, with a central axial mandrel about which the bars are bent and an eccentric pivot pin for bending the bars about the mandrel, as well as an abutment element against which the bars bear laterally during the bending operation, said central mandrel and said abutment element defining between them said area for

receiving the bars to be bent, in which the bars are set side by side to each other in a plane substantially perpendicular to the plane of the bending disk.

36. A method as claimed in claim 34 or 35, wherein the, or each, set of pliers draws one or more bars from the aforesaid reception area over each bending unit, after the bars are bent, and deposits the bent bars in a third station of the plant.

37. A method as claimed in claim 29 or 36, wherein said jaw means are swivelling relative to their support structure also about a second axis of rotation which is perpendicular to the aforesaid axis of articulation, and wherein said pliers means draw the bars bent by the aforesaid second station after being oriented about said second axis of rotation according to the orientation of the portion of the bent bars to be gripped.

38. A method as claimed in claim 36 or 37, wherein the bent bars are gripped in proximity to their centre of gravity.

39. A method as claimed in any of the claims 29, 34-36 and 38, wherein said bars are handled by means of a single set of pliers which grips them in proximity to the centre of gravity.

40. A method as claimed in claim 36 or 38 or 39, wherein means are provided for controlling the pliers, programmable to calculate the position of the centre of gravity of the bars.

41. A method as claimed in claim 29, wherein said bars are drawn from the drawing station by means of pliers after they are all oriented with the fins of the ribs in the same direction.

42. A method as claimed in claim 29, wherein the movable structure for supporting the jaw means of the, or of each, set of pliers is movable both along a first direction that is horizontal and parallel to a longitudinal direction of lay of the bars in the installation, and along a second direction that is horizontal and perpendicular to the longitudinal direction of the bars.

43. A method as claimed in any of the claims 29, 34-37 and 42, wherein said movable structure is also movable in a direction that is perpendicular to the plane of the second station, for instance defined by the plane of the bending disk of a bending unit.

44. A method as claimed in claim 29 or 43, wherein the movable structure for supporting the jaw means of the, or of each, set of pliers is not movable along a direction parallel to the horizontal longitudinal direction of lay of the bars in the installation, and is instead movable along a direction that is horizontal and perpendicular to the longitudinal direction of the bars, and wherein the bars are gripped in said first station and transferred by said pliers means in the aforesaid second station without changing the position of the bars in their longitudinal direction and after making them rotate from the first orientation to the second orientation by rotation about said axis of articulation.

45. A method as claimed in claim 44, wherein the, or each, bending unit is provided with reference means for the correct longitudinal position of the bars, for instance means for butting the bars.

46. A method as claimed in any of the claims 29,34,35,37, wherein the points in which the bars are gripped by the pliers in the first station are a function of weight distribution, of the length and diameter of the bars, and/or in that, the second station being constituted by a bending installation in the unloading phase from the pliers the distance along between pliers and mandrels of the bending units is a function of one ore more of the following parameters: bar diameter, bar length, length of the overhanging segment beyond the closest set of pliers.

47. A method as claimed in claim 29 or 43, wherein programmable means are provided for controlling the motion of the, or of each, set of pliers, which control the velocity of motion as a function of one or more parameters chosen among: bar diameter, length of the tail segment of the bar positioned beyond the closest gripping pliers, weight of the bars, shape of the bar (in the case of bent bars), number of the bars.

48. A method as claimed in claim 29 or 43, wherein a single bending unit is provided, and said pliers means are also used to translate the bars in the longitudinal direction relative to said bending unit, in order to achieve the required bends in different segments of the bars.

49. An installation as claimed in claim 1, wherein the movable structure for supporting the jaw means of

the, or of each, set of pliers is movable both along a first direction which is horizontal and perpendicular to the longitudinal direction of the bars, and along a second direction orthogonal to a plane of said second station.

50. An installation as claimed in claim 2 or 3, wherein two bending units are provided as well as a plurality of planes able to be lowered for supporting the bars, able to fill the available space along the longitudinal direction between the two bending units or externally thereto.

51. An installation as claimed in claim 3, wherein to at least a bending unit can be associated an auxiliary support, movable between an inoperative position to the rear and an operative position in which it surmounts at least partially the revolving disk of the bending unit, in such a way that, in a cycle of bending operations necessary to obtain a closed loop stirrup of quadrangular shape starting from a rectilinear bar, it is assured, in the final phase of the bending cycle, that the end portions of the bar constituting each stirrup are mutually approached without risk of interference between the bar portions in motion and the central mandrel of the bending unit and/or the opposite ends of the bars.

52. An installation as claimed in claim 3, wherein the, or each, bending unit comprises means for adjusting the distance between mandrel and butting organ in a direction transverse to the longitudinal direction and control means for commanding said adjustment means to adjust automatically the width of

the space for receiving the bars as a function of the diameter of the bars.

53. An installation as claimed in any of the claims 6-8, 15-17 or 49 wherein said second station is constituted by the upper planes of the bending units.